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**Yamada**

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(54) **PROGRAM SCHEDULE GENERATING DEVICE AND PROGRAM SCHEDULE GENERATING METHOD**

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(51) **Int. Cl.**

| | |
|---|---|
| ***G06F 13/00*** | (2006.01) |
| ***G06F 3/00*** | (2006.01) |
| ***H04N 5/445*** | (2011.01) |
| ***H04N 21/462*** | (2011.01) |

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(52) **U.S. Cl.**

CPC ..... ***H04N 21/462*** (2013.01); ***H04N 21/4314*** (2013.01); ***H04N 21/4586*** (2013.01); ***H04N 21/4821*** (2013.01); ***H04N 21/4823*** (2013.01); ***H04N 21/854*** (2013.01)

(58) **Field of Classification Search**

CPC ..... H04N 5/44543; H04N 21/482; H04N 21/4622; H04N 21/47214; H04N 21/4821

See application file for complete search history.

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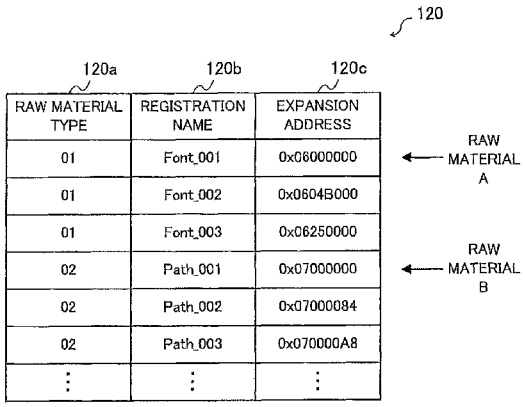
(57) **ABSTRACT**

A program schedule generating device includes a program schedule individual data generating unit that generates program schedule individual data including graphics rendering definitions for using raw material data to form images indicating display information, and raw material data reference information indicating the positions on video memory at which the raw material data used in the graphics rendering definitions are stored, a program schedule display list generating unit that generates a program schedule display list indicating the positions at which to display the image rendered on the basis of the program schedule individual data for each item of the program schedule individual data, and a rendering unit that renders the image for each program by use of the raw material data on the basis of the program schedule individual data and places the rendered image on the basis of the program schedule display list, thereby generating the screen data for a program schedule screen.

**18 Claims, 10 Drawing Sheets**



(51) **Int. Cl.**

| | |
|---|---|
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| ***H04N 21/458*** | (2011.01) |
| ***H04N 21/854*** | (2011.01) |
| ***H04N 21/482*** | (2011.01) |

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FIG. 1

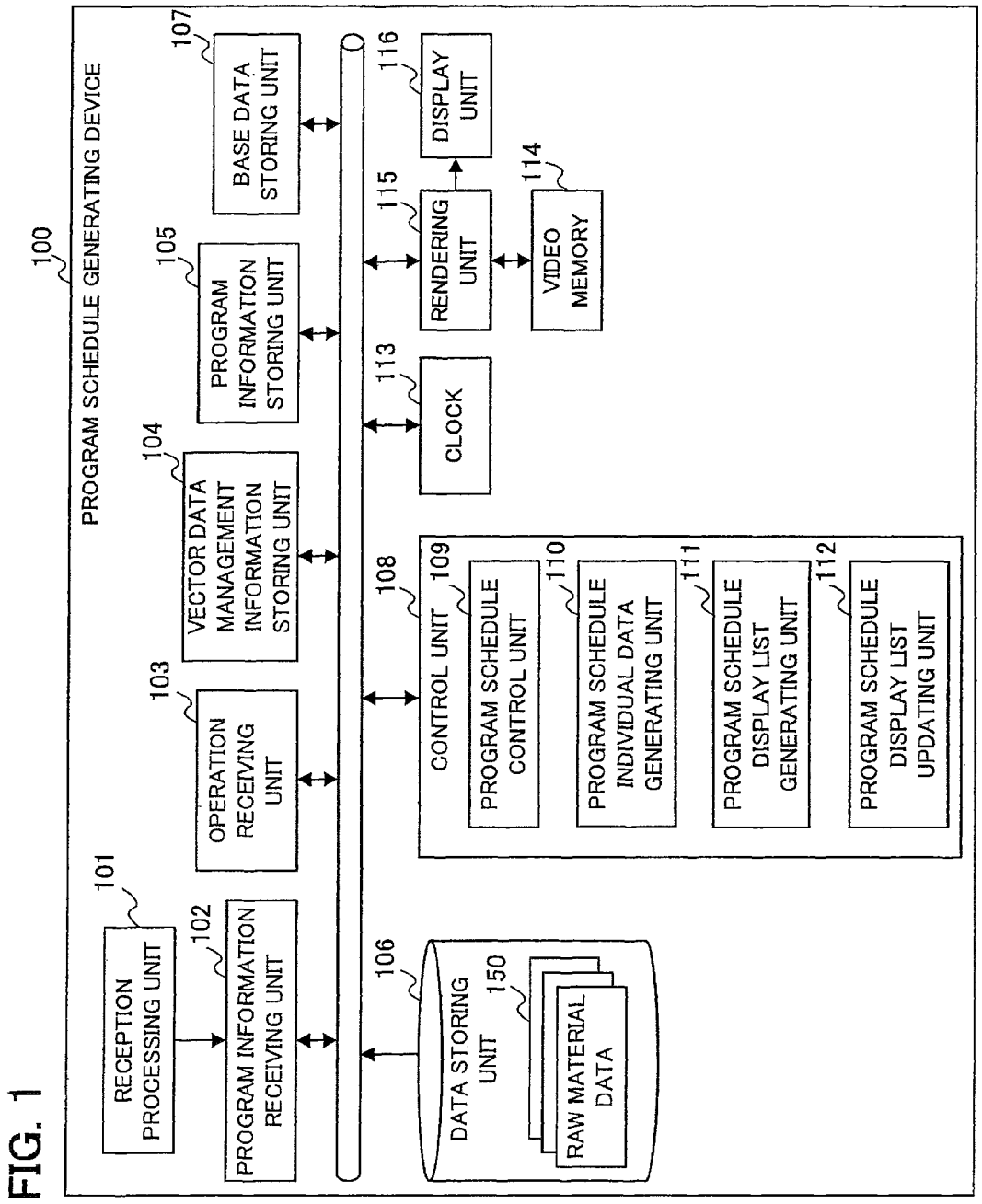

100
PROGRAM SCHEDULE GENERATING DEVICE
101
RECEPTION PROCESSING UNIT
102
PROGRAM INFORMATION RECEIVING UNIT
103
OPERATION RECEIVING UNIT
104
VECTOR DATA MANAGEMENT INFORMATION STORING UNIT
105
PROGRAM INFORMATION STORING UNIT
107
BASE DATA STORING UNIT
106
DATA STORING UNIT
150
RAW MATERIAL DATA
108
CONTROL UNIT
109
PROGRAM SCHEDULE CONTROL UNIT
110
PROGRAM SCHEDULE INDIVIDUAL DATA GENERATING UNIT
111
PROGRAM SCHEDULE DISPLAY LIST GENERATING UNIT
112
PROGRAM SCHEDULE DISPLAY LIST UPDATING UNIT
113
CLOCK
115
RENDERING UNIT
114
VIDEO MEMORY
116
DISPLAY UNIT

FIG. 2

120

| 120a RAW MATERIAL TYPE | 120b REGISTRATION NAME | 120c EXPANSION ADDRESS | |
|---|---|---|---|
| 01 | Font_001 | 0x06000000 | ← RAW MATERIAL A |
| 01 | Font_002 | 0x0604B000 | |
| 01 | Font_003 | 0x06250000 | |
| 02 | Path_001 | 0x07000000 | ← RAW MATERIAL B |
| 02 | Path_002 | 0x07000084 | |
| 02 | Path_003 | 0x070000A8 | |
| ⋮ | ⋮ | ⋮ | |

FIG. 3

130

| 130a FONT ID | 130b CHARACTER CODE | 130c REFERENCE ADDRESS | 130d SIZE | |
|---|---|---|---|---|
| ⋮ | ⋮ | ⋮ | ⋮ | |
| 003 | 304A | 0x000F4E20 | 518 | ← O |
| 003 | 304B | 0x000F5020 | 394 | ← KA |
| 003 | 304C | 0x000F51B0 | 462 | ← GA |
| 003 | 304D | 0x000F537E | 390 | ← KI |
| ⋮ | ⋮ | ⋮ | ⋮ | |
| 003 | 306F | 0x000F8086 | 432 | ← HA |
| ⋮ | ⋮ | ⋮ | ⋮ | |

FIG. 4

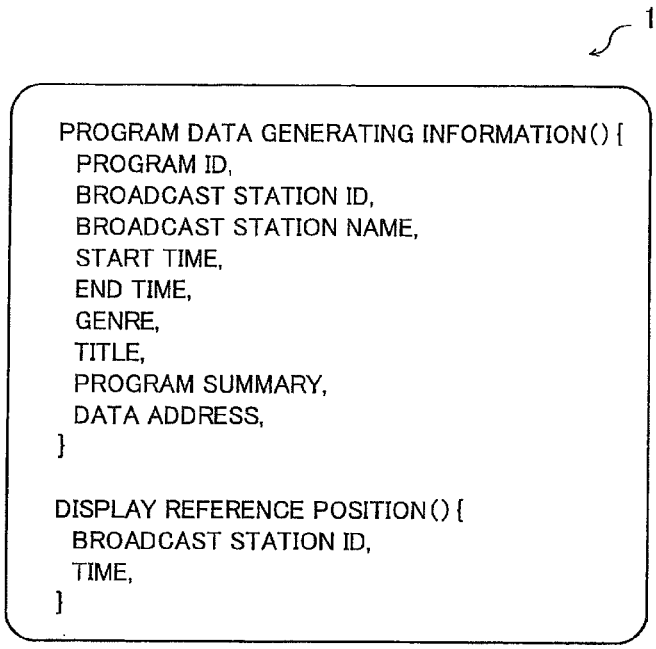

140
PROGRAM DATA GENERATING INFORMATION() {
PROGRAM ID,
BROADCAST STATION ID,
BROADCAST STATION NAME,
START TIME,
END TIME,
GENRE,
TITLE,
PROGRAM SUMMARY,
DATA ADDRESS,
}
DISPLAY REFERENCE POSITION() {
BROADCAST STATION ID,
TIME,
}

FIG. 5

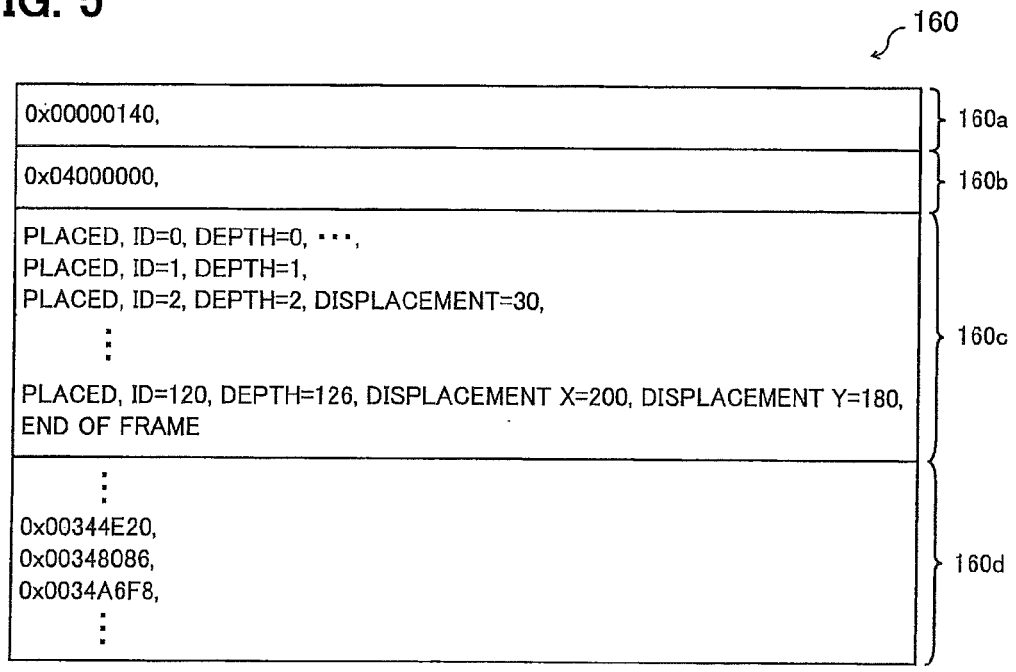

160
0x00000140,
160a
0x04000000,
160b
PLACED, ID=0, DEPTH=0, ・・・,
PLACED, ID=1, DEPTH=1,
PLACED, ID=2, DEPTH=2, DISPLACEMENT=30,
PLACED, ID=120, DEPTH=126, DISPLACEMENT X=200, DISPLACEMENT Y=180,
END OF FRAME
160c
0x00344E20,
0x00348086,
0x0034A6F8,
160d

FIG. 6

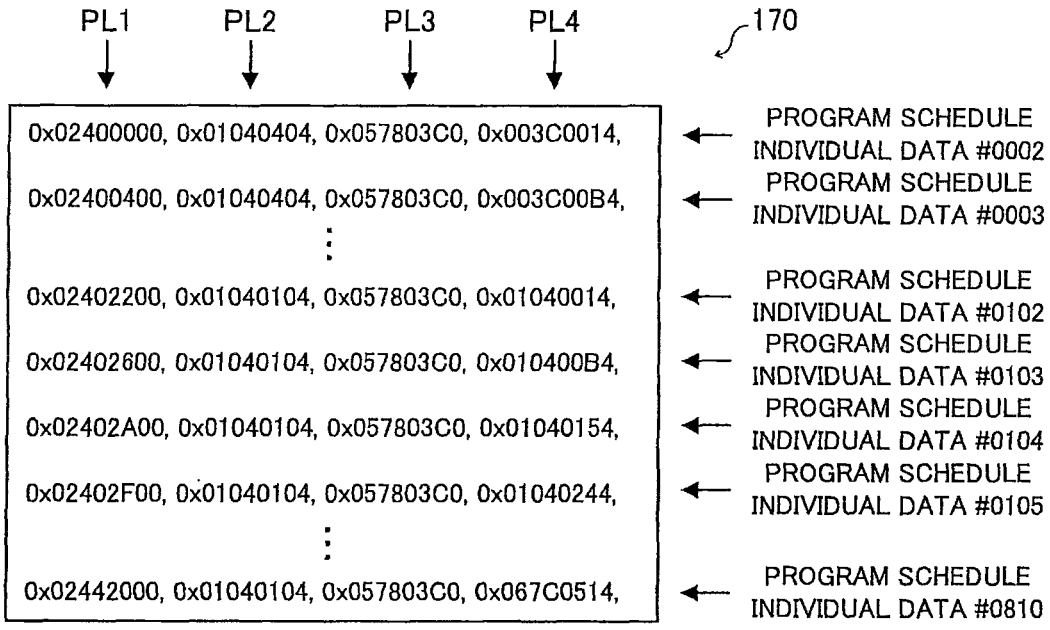

PL1
PL2
PL3
PL4
170
0x02400000, 0x01040404, 0x057803C0, 0x003C0014,
0x02400400, 0x01040404, 0x057803C0, 0x003C00B4,
0x02402200, 0x01040104, 0x057803C0, 0x01040014,
0x02402600, 0x01040104, 0x057803C0, 0x010400B4,
0x02402A00, 0x01040104, 0x057803C0, 0x01040154,
0x02402F00, 0x01040104, 0x057803C0, 0x01040244,
0x02442000, 0x01040104, 0x057803C0, 0x067C0514,
PROGRAM SCHEDULE INDIVIDUAL DATA #0002
PROGRAM SCHEDULE INDIVIDUAL DATA #0003
PROGRAM SCHEDULE INDIVIDUAL DATA #0102
PROGRAM SCHEDULE INDIVIDUAL DATA #0103
PROGRAM SCHEDULE INDIVIDUAL DATA #0104
PROGRAM SCHEDULE INDIVIDUAL DATA #0105
PROGRAM SCHEDULE INDIVIDUAL DATA #0810

FIG. 7

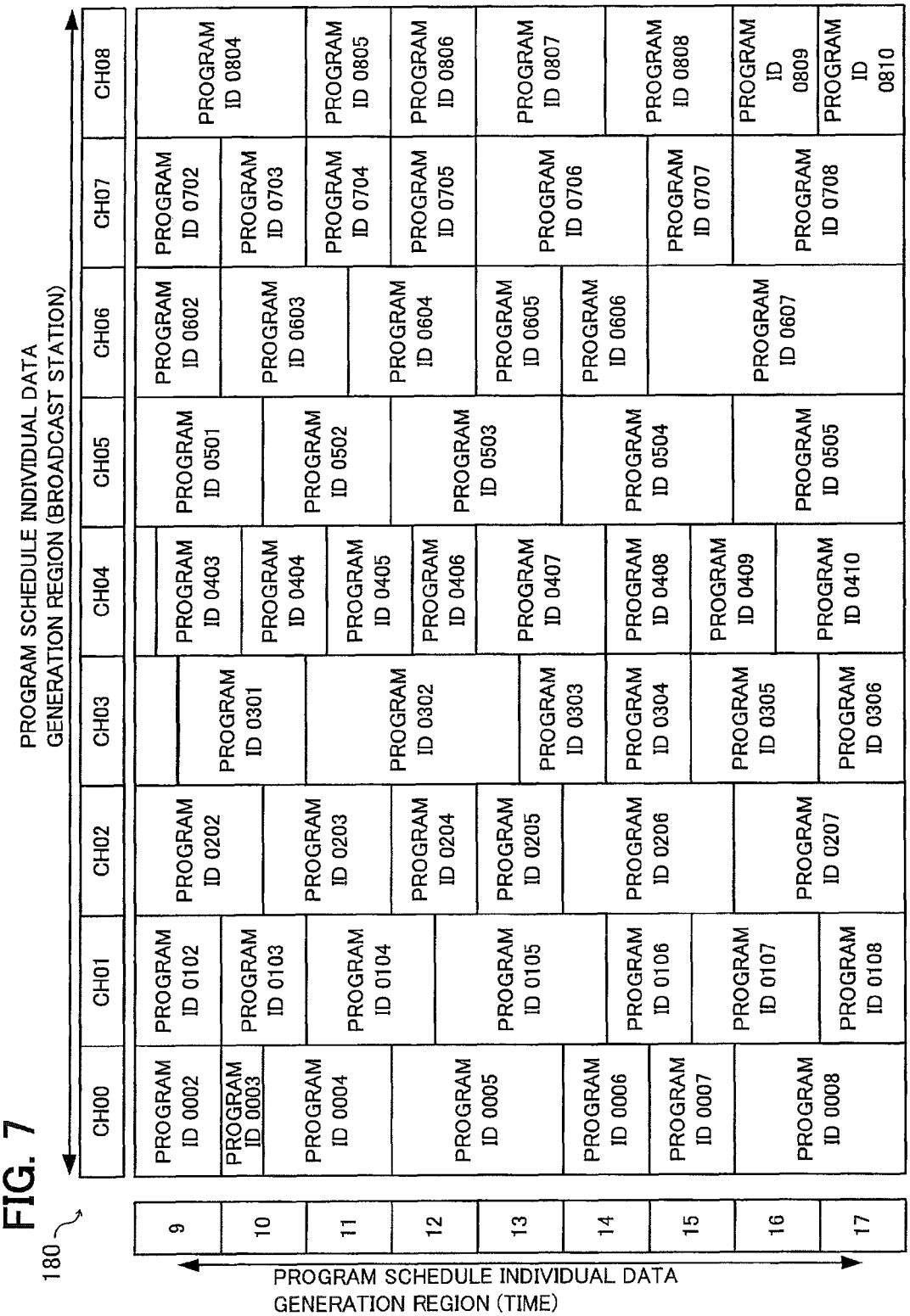

180
PROGRAM SCHEDULE INDIVIDUAL DATA GENERATION REGION (BROADCAST STATION)
CH00
CH01
CH02
CH03
CH04
CH05
CH06
CH07
CH08
PROGRAM ID 0002
PROGRAM ID 0102
PROGRAM ID 0202
PROGRAM ID 0301
PROGRAM ID 0403
PROGRAM ID 0501
PROGRAM ID 0602
PROGRAM ID 0702
PROGRAM ID 0804
PROGRAM ID 0003
PROGRAM ID 0103
PROGRAM ID 0404
PROGRAM ID 0703
PROGRAM ID 0004
PROGRAM ID 0104
PROGRAM ID 0203
PROGRAM ID 0302
PROGRAM ID 0405
PROGRAM ID 0502
PROGRAM ID 0603
PROGRAM ID 0704
PROGRAM ID 0805
PROGRAM ID 0005
PROGRAM ID 0105
PROGRAM ID 0204
PROGRAM ID 0406
PROGRAM ID 0503
PROGRAM ID 0604
PROGRAM ID 0705
PROGRAM ID 0806
PROGRAM ID 0006
PROGRAM ID 0205
PROGRAM ID 0303
PROGRAM ID 0407
PROGRAM ID 0504
PROGRAM ID 0605
PROGRAM ID 0706
PROGRAM ID 0807
PROGRAM ID 0007
PROGRAM ID 0106
PROGRAM ID 0206
PROGRAM ID 0304
PROGRAM ID 0408
PROGRAM ID 0606
PROGRAM ID 0707
PROGRAM ID 0808
PROGRAM ID 0008
PROGRAM ID 0107
PROGRAM ID 0207
PROGRAM ID 0305
PROGRAM ID 0409
PROGRAM ID 0505
PROGRAM ID 0607
PROGRAM ID 0708
PROGRAM ID 0809
PROGRAM ID 0108
PROGRAM ID 0306
PROGRAM ID 0410
PROGRAM ID 0810
9
10
11
12
13
14
15
16
17
PROGRAM SCHEDULE INDIVIDUAL DATA GENERATION REGION (TIME)

FIG. 8

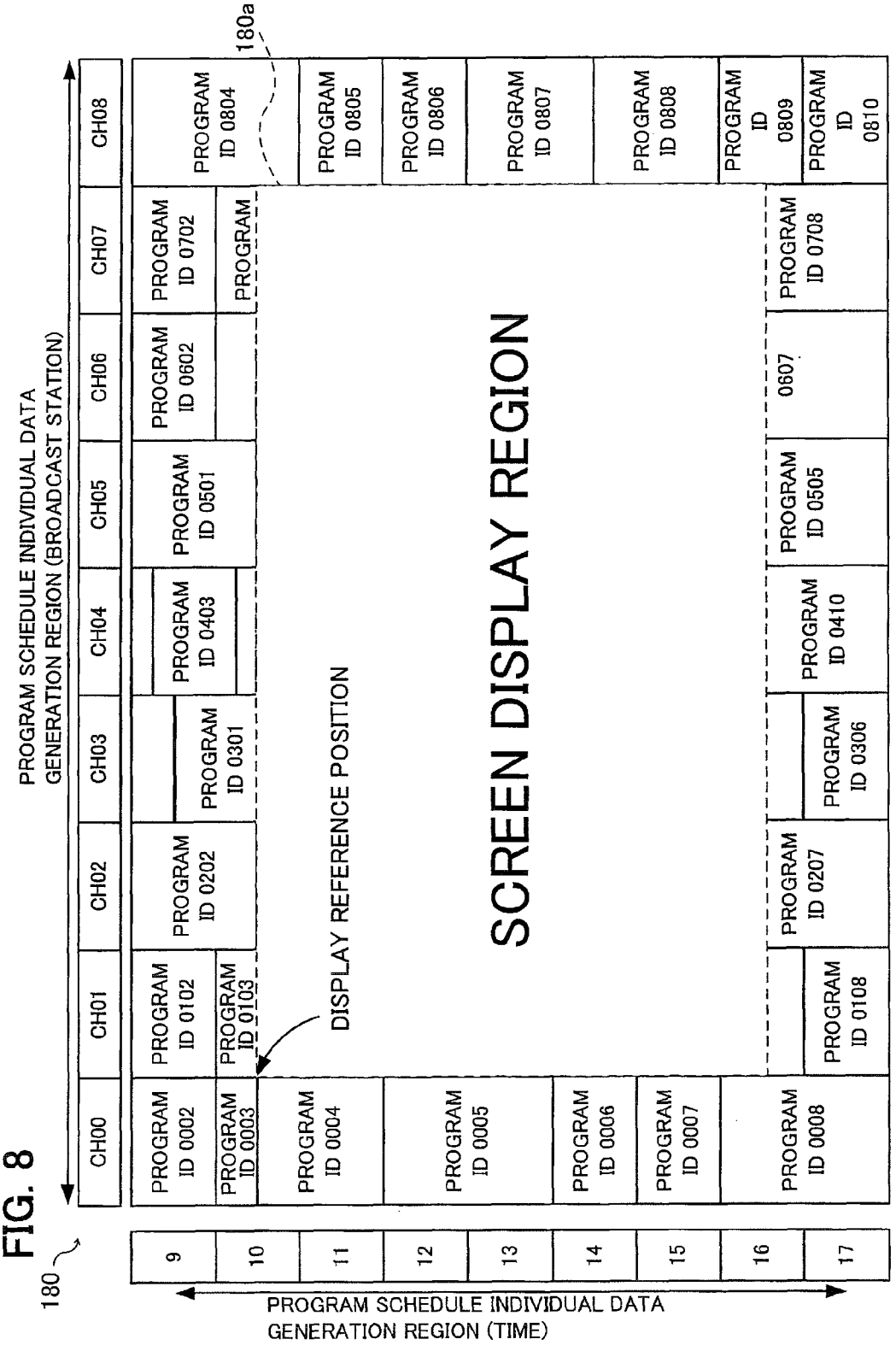

180
180a
PROGRAM SCHEDULE INDIVIDUAL DATA GENERATION REGION (BROADCAST STATION)
CH00
CH01
CH02
CH03
CH04
CH05
CH06
CH07
CH08
9
10
11
12
13
14
15
16
17
PROGRAM SCHEDULE INDIVIDUAL DATA GENERATION REGION (TIME)
DISPLAY REFERENCE POSITION
SCREEN DISPLAY REGION
PROGRAM ID 0002
PROGRAM ID 0003
PROGRAM ID 0004
PROGRAM ID 0005
PROGRAM ID 0006
PROGRAM ID 0007
PROGRAM ID 0008
PROGRAM ID 0102
PROGRAM ID 0103
PROGRAM ID 0108
PROGRAM ID 0202
PROGRAM ID 0207
PROGRAM ID 0301
PROGRAM ID 0306
PROGRAM ID 0403
PROGRAM ID 0410
PROGRAM ID 0501
PROGRAM ID 0505
PROGRAM ID 0602
0607
PROGRAM ID 0702
PROGRAM ID 0708
PROGRAM ID 0804
PROGRAM ID 0805
PROGRAM ID 0806
PROGRAM ID 0807
PROGRAM ID 0808
PROGRAM ID 0809
PROGRAM ID 0810

FIG. 9

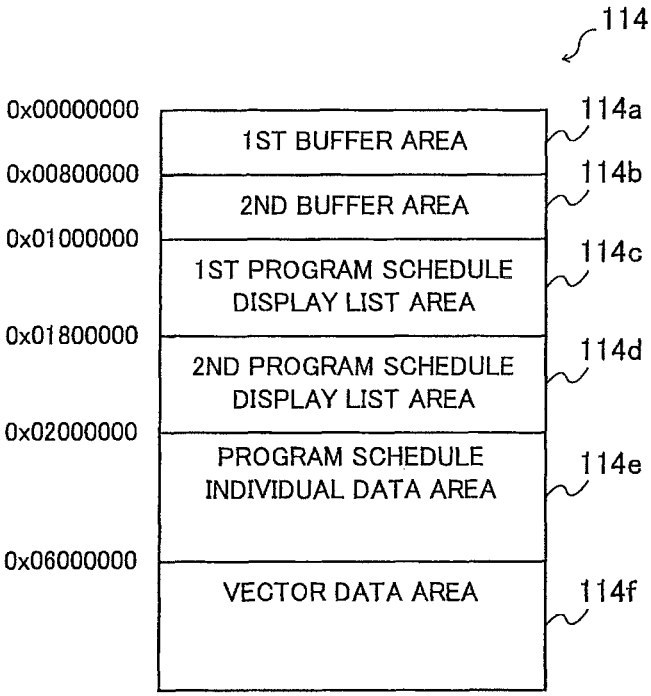

114
0x00000000
1ST BUFFER AREA
114a
0x00800000
2ND BUFFER AREA
114b
0x01000000
1ST PROGRAM SCHEDULE DISPLAY LIST AREA
114c
0x01800000
2ND PROGRAM SCHEDULE DISPLAY LIST AREA
114d
0x02000000
PROGRAM SCHEDULE INDIVIDUAL DATA AREA
114e
0x06000000
VECTOR DATA AREA
114f

FIG. 10

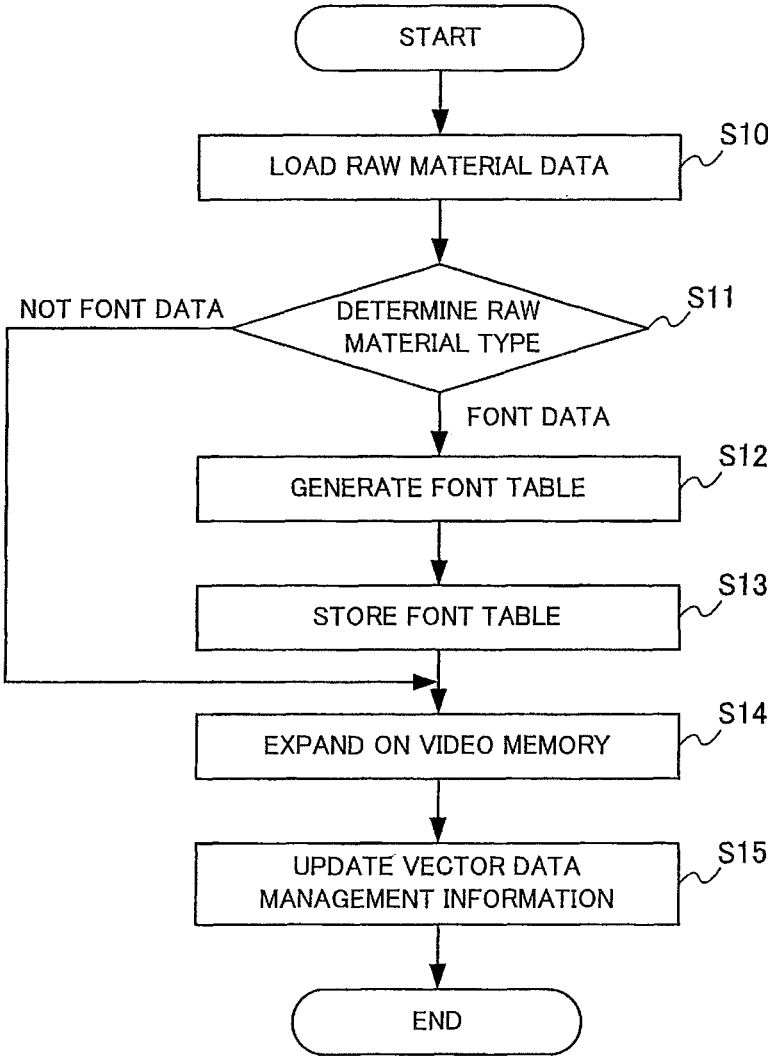

START
LOAD RAW MATERIAL DATA
S10
DETERMINE RAW MATERIAL TYPE
S11
NOT FONT DATA
FONT DATA
GENERATE FONT TABLE
S12
STORE FONT TABLE
S13
EXPAND ON VIDEO MEMORY
S14
UPDATE VECTOR DATA MANAGEMENT INFORMATION
S15
END

FIG. 11

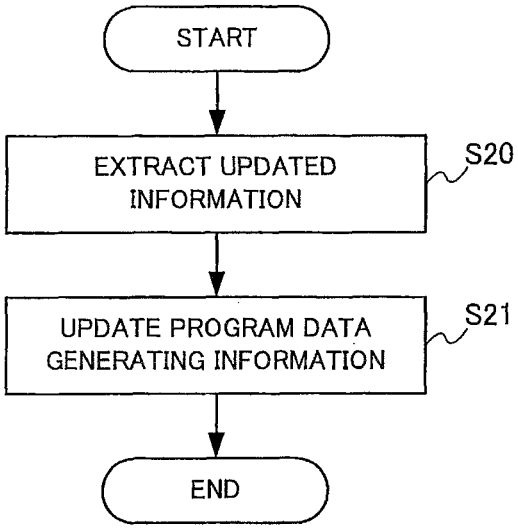
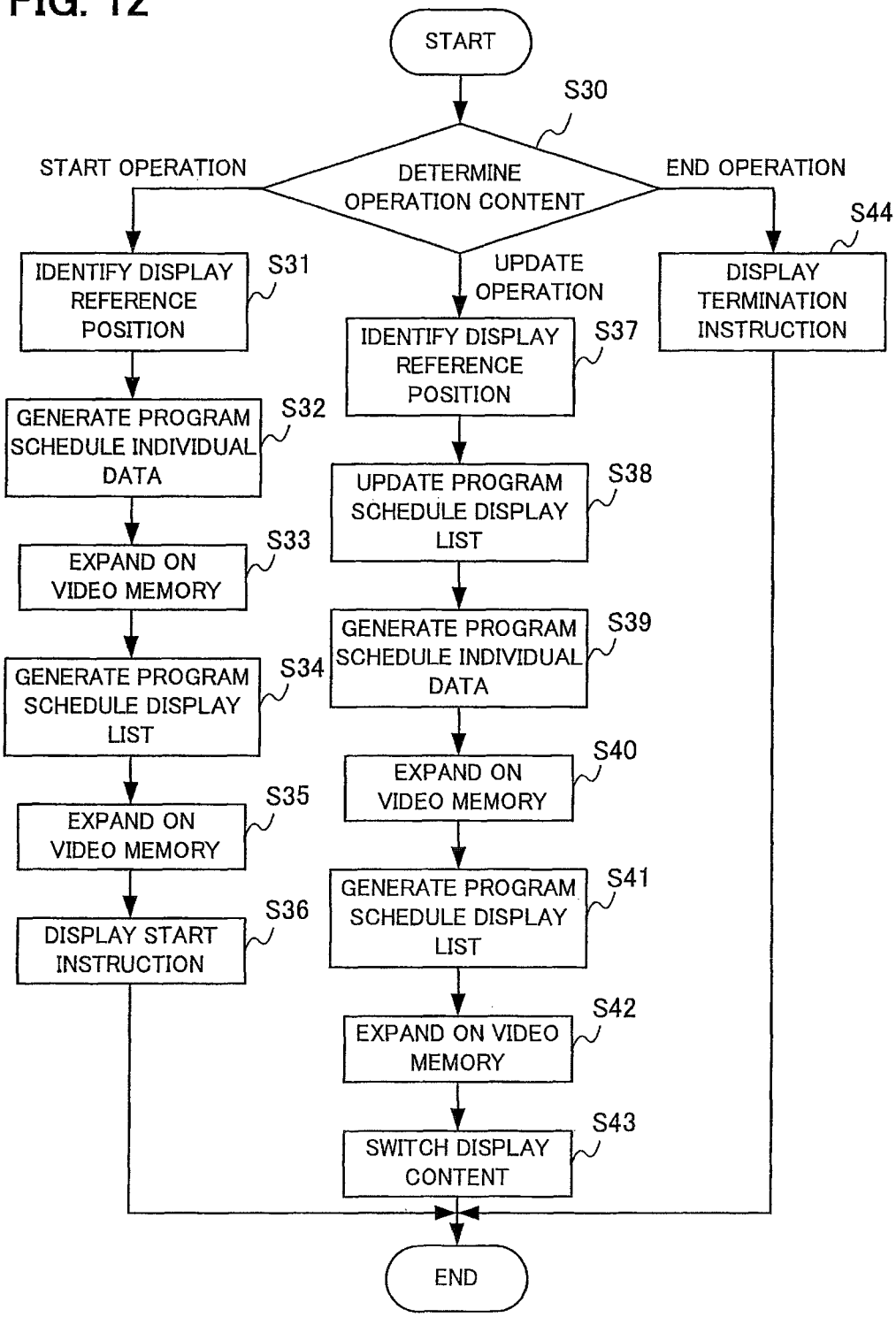

START
EXTRACT UPDATED INFORMATION
S20
UPDATE PROGRAM DATA GENERATING INFORMATION
S21
END

FIG. 12


START
S30
DETERMINE OPERATION CONTENT
START OPERATION
UPDATE OPERATION
END OPERATION
S44
IDENTIFY DISPLAY REFERENCE POSITION
S31
GENERATE PROGRAM SCHEDULE INDIVIDUAL DATA
S32
EXPAND ON VIDEO MEMORY
S33
GENERATE PROGRAM SCHEDULE DISPLAY LIST
S34
EXPAND ON VIDEO MEMORY
S35
DISPLAY START INSTRUCTION
S36
IDENTIFY DISPLAY REFERENCE POSITION
S37
UPDATE PROGRAM SCHEDULE DISPLAY LIST
S38
GENERATE PROGRAM SCHEDULE INDIVIDUAL DATA
S39
EXPAND ON VIDEO MEMORY
S40
GENERATE PROGRAM SCHEDULE DISPLAY LIST
S41
EXPAND ON VIDEO MEMORY
S42
SWITCH DISPLAY CONTENT
S43
DISPLAY TERMINATION INSTRUCTION
END

# PROGRAM SCHEDULE GENERATING DEVICE AND PROGRAM SCHEDULE GENERATING METHOD

## FIELD OF THE INVENTION

The present invention relates to a program schedule generating device and a program schedule generating method.

## BACKGROUND ART

In digital broadcasting, each broadcast station can transmit program data on its broadcast signal, so receiving devices generally have a function for displaying the program schedule of each broadcast station as an electronic program guide on a television screen or the like.

An electronic program guide can be used to display, in addition to an electronic program schedule, the title and air time of the currently tuned program, summaries of programs and their performers, program reservations, and so on. In particular, an electronic program schedule enables the program information for multiple broadcast stations in a desired time slot to be displayed, which is useful in checking broadcast schedules and searching for programs.

A technique for preventing user operations on an electronic program schedule from being interrupted by update of the electronic program schedule is disclosed in Patent Reference 1. The electronic program schedule generating device disclosed in Patent Reference 1 is configured so as not to execute update processing on the electronic program schedule while the user continues to operate on the electronic program schedule. Therefore, the technique disclosed in Patent Reference 1 can enhance operability by preventing user operations from being temporarily interrupted by electronic program schedule update processing.

## PRIOR ART REFERENCES

### Patent Documents

Patent Reference 1: Japanese Patent Application Publication No. 2007-28076 (paragraph 0019, FIG. 1)

## SUMMARY OF THE INVENTION

### Problem to be Solved by the Invention

With the technique described in Patent Reference 1, however, there is the possibility that if a program broadcast ends while the user is carrying out an operation on the electronic program schedule, the content of the currently displayed electronic program schedule may differ from the current broadcast program content.

Furthermore, the time slots or broadcast stations displayed on an electronic program schedule can generally be changed by scrolling the displayed content with key operations or the like. However, since an electronic program schedule has a large amount of information to display, changing the display screen by generating screen data from scratch requires much time. Accordingly, a user who, for example, makes a mistake in a key operation and must perform the key operation again after the display screen has changed experiences much stress on account of the slow response of the display.

It is therefore an object of the present invention to reduce the processing load and processing time associated with electronic program schedules, thereby enabling the more responsive display of electronic program schedules.



### Means for Solving the Problem

A program schedule generating device according to an embodiment of the invention includes: a video memory for storing raw material data that are vector data for image rendering; a program information storing unit for storing program data generating information including display information to be displayed for each program in a program schedule; a program schedule individual data generating unit for generating program schedule individual data for each program, including graphic rendering definitions for using the raw material data to form an image indicating the display information, and raw material data reference information indicating storage locations, in the video memory, of the raw material data used in the graphic rendering definitions; a program schedule display list generating unit for generating a program schedule display list indicating, for each of the program schedule individual data, a position at which to place the image rendered on a basis of the program schedule individual data; and a rendering unit for rendering the image for each program by use of the raw material data on the basis of the program schedule individual data and placing the rendered image on a basis of the program schedule display list, thereby generating screen data for a program schedule screen.

### Effects of the Invention

According to an embodiment of the invention, the processing load and processing time associated with electronic program schedules can be reduced, so electronic program schedules can be displayed more responsively.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the schematic configuration of a program schedule generating device.

FIG. **2** is a schematic diagram showing an exemplary raw material data expansion table.

FIG. **3** is a schematic diagram showing an exemplary font table.

FIG. **4** is a schematic diagram showing exemplary program schedule related information.

FIG. **5** is a schematic diagram showing exemplary program schedule individual data.

FIG. **6** is a schematic diagram showing an example of the data structure of a program schedule list.

FIG. **7** is a schematic diagram showing an exemplary program schedule.

FIG. **8** is a schematic diagram showing an exemplary screen display region in the program schedule.

FIG. **9** is a schematic diagram showing an exemplary video memory structure.

FIG. **10** a flowchart schematically illustrating an initial process of the program schedule generating device.

FIG. **11** is a flowchart schematically illustrating a process when program information is updated by the program schedule generating device.

FIG. **12** is a flowchart schematically illustrating a process in the program schedule generating device when a user operation is performed.

## MODE FOR CARRYING OUT THE INVENTION

FIG. **1** is a block diagram showing the schematic configuration of a program schedule generating device **100** in an

embodiment. The program schedule generating device **100** includes a reception processing unit **101**, a program information receiving unit **102**, an operation receiving unit **103**, a vector data management information storing unit **104**, a program information storing unit **105**, a data storing unit **106**, a base data storing unit **107**, a control unit **108**, a clock **113**, a video memory **114**, a rendering unit **115**, and a display unit **116**. The reception processing unit **101** and program information receiving unit **102** constitute a program information acquisition unit.

The reception processing unit **101** generates a TS (Transport Stream) as a digital signal from a radio signal received by an antenna, not shown in the drawings, and separates SI (Service Information), which is program table information, from the TS. Then the reception processing unit **101** sends the separated SI to the program information receiving unit **102**. Here, for example, the TS generated by the reception processing unit **101** is an MPEG-2 (Moving Picture Experts Group 2) TS.

The program information receiving unit **102** acquires program information necessary to configure a program schedule from the SI. The program information includes information related to programs to be broadcast. The program information receiving unit **102** sends the acquired program information to the control unit **108**. Here, in this embodiment, the program information includes at least a TOT (Time Offset Table), an EIT_p/f (Event Information Table present/following), and an EIT_s (Event Information Table schedule). The TOT includes information regarding the current time and date and information indicating offset times for daylight saving time implementation. From among the information in the EIT (Event Information Table), which gives program names, broadcast dates and times, program content, and other program related information, the EIT_p/f includes information indicating the current programs (present) and the next programs (following). The EIT_s is schedule information in the EIT; it includes, for example, an eight-day program schedule.

The operation receiving unit **103** accepts input from user operations. The operation receiving unit **103** can be implemented by, for example, a key input device (a keyboard, a touch panel, a remote control, etc.), a pointing device (a mouse, etc.), or an interface having functions for communicating with an external device. The operation receiving unit **103** then notifies the control unit **108** of the user operation information of which it has accepted input.

The vector data management information storing unit **104** stores a raw material data expansion table **120** indicating relationships between raw material vector data and addresses on the video memory **114** when the raw material vector data are expanded onto the video memory **114** and, when the raw material data are font data, a font table **121** indicating relationships between character codes in the font data and the addresses at which the glyph data of the character codes are stored in the font data.

FIG. **2** is a schematic diagram showing an exemplary raw material data expansion table **120**. As shown, the raw material data expansion table **120** includes a raw material type field **120***a*, a registration name field **120***b*, and an expansion address field **120***c*.

The raw material type field **120***c* stores the raw material type, which is raw material identification information indicating whether the raw material data **150**, which are vector data, are font data, or path data other than font data.

The registration name field **120***b* stores registration names, which are indexes unique to the raw material data **150** to be expanded onto the video memory **114**.

The expansion address field **120***c* stores expansion addresses at which the raw material data **150** identified in the registration name field **120***b* are expanded onto the video memory **114**.

When program schedule individual data **160** are generated as described later, the above indexes identify the addresses on the video memory **114** of the vector data (raw material data **150**) used in rendering.

The example in FIG. **2** indicates that raw material A is raw material of the font data type, and that the vector data are registered with index 'Font_001' and expanded at address '0x06000000' and addresses thereafter on the video memory **114**. This example also indicates that raw material B is raw material of the path data type, and that the vector data are registered with index 'Path_001' and expanded at address '0x07000000' and addresses thereafter.

FIG. **3** is a schematic diagram showing an exemplary font table **130**. As shown, the font table **130** includes a font ID field **130***a*, a character code field **130***b*, a reference address field **130***c*, and a size field **130***d*.

The font ID field **130***a* stores font IDs, which are font identification information for identifying font data. A font ID gives a three-digit number included in the index (registration name) of the font data registered in the raw material data expansion table **120**.

The character code field **130***b* stores character codes, which are character identification information for identifying the characters included in the font data designated in the font ID field **130***a*.

The reference address field **130***c* stores reference addresses indicating the addresses on the font data at which the glyph data of the characters indicated by the character codes designated in the character code field **130***b* are stored.

The size field **130***d* stores the data size of the glyph data indicated by the character codes designated in the character code field **130***b*.

The example in FIG. **3** indicates that the hiragana character 'o' with character code '304A' included in the font data 'Font_003' identified by font ID '003' has glyph data with a size of '512' bytes at font data address '0x000F4E20'. Similarly, the hiragana character 'ga' with character code '304C' has glyph data with a size of '462' bytes at font data address '0x000F51B0'.

Returning to the description of FIG. **1**, the program information storing unit **105** stores program schedule related information **140** including program data generating information which indicates the latest program information obtained from the program information receiving unit **102** and generation or non-generation of the program schedule individual data **160** for each program, and the display reference position of the program schedule. FIG. **4** is a schematic diagram showing exemplary program schedule related information **140**. As illustrated, the program schedule related information **140** includes program data generating information including a program ID, broadcast station ID, broadcast station name, start time, end time, genre, title, program summary, and data address, and a display reference position including a broadcast station ID and time.

The program ID is an index assigned to each program.

The broadcast station ID is an index assigned to the broadcast station that broadcasts the program identified by the program ID.

The broadcast station name is the name of the broadcast station that broadcasts the program identified by the program ID.

The start time is the starting time of the program identified by the program ID.

The end time is the ending time of the program identified by the program ID.

Here, the start time and end time define the airtime of the program identified by the program ID.

The genre is category information for the program identified by the program ID, indicating a category such as movie, sports, or news, for example.

The title is the name of the program identified by the program ID.

The program summary is information that indicates the content of the program identified by the program ID. The program summary includes performers etc. in the program identified by the program ID.

The above information, from the program ID to the program summary, is extracted from the program information sent from the program information receiving unit **102**, and is stored in the program data generating information for each program. Since a program schedule displays titles and program summaries, the titles and program summaries constitute the display information.

The data address represents the address on the video memory **114** when the program schedule individual data **160** corresponding to the program identified by the program ID are stored on the video memory **114** as described later.

The display reference position indicates a broadcast station and time that are used as a reference for display of the program schedule. The display reference position is, for example, information that indicates the upper left display starting position in the actually displayed screen display region in the program schedule. In this embodiment, the display starting position of the screen display region is indicated by a broadcast station ID and time.

Returning to the description of FIG. **1**, the data storing unit **106** stores multiple items of raw material data **150** for generating images of the component parts that constitute the screen data of the program schedule screen. The raw material data **150** are, for example, vector data including vector graphics data for icon data and logo marks and vector font data (outline font data). It will be assumed that unique three-digit numbers are individually assigned to the graphics data and font data as data identification information.

The base data storing unit **107** stores generating rule information that indicates generating rules to be applied in generating the image for each program in a program schedule screen. The generating rule information includes, for example, information designating a background color for each genre in the image of each program, information designating font IDs and character sizes of characters used in the program schedule, information designating the placement of the channel corresponding to the broadcast station ID indicated by the display reference position, reference positional information indicating the reference position (e.g., x=260 pixels, y=260 pixels) of the screen display region, etc. The base data storing unit **107** also stores display parameters indicating the width per broadcast station and height per hour when images are generated for each program. The base data storing unit **107** further stores channel information indicating broadcast station IDs and, in association therewith, the channels used by the broadcast stations identified by the broadcast station IDs.

The control unit **108** exercises general control over the processing in the program schedule generating device **100**. For example, the control unit **108** generates a display list and individual data for configuring the screen data of the program schedule screen, and updates the display list. Here, the control unit **108** includes a program schedule control unit **109**, a program schedule individual data generating unit **110**, a program schedule display list generating unit **111**, and a program schedule display list updating unit **112**.

The program schedule control unit **109** controls the overall program schedule display processing. For example, the program schedule control unit **109** notifies the rendering unit **115** of display instructions, thereby causing the display unit **116** to display a program schedule screen. The program schedule control unit **109** also notifies the rendering unit **115** of switch-over instructions, thereby changing the screen displayed on the display unit **116**. In addition, the program schedule control unit **109** executes processing corresponding to the content of operations accepted as input by the operation receiving unit **103**.

To generate program schedule individual data **160** for each program, the program schedule individual data generating unit **110** uses the program schedule related information **140** stored in the program information storing unit **105** and the address information stored in the raw material data expansion table **120** stored in the vector data management information storing unit **104**, giving the addresses of the raw material data **150** on the video memory **114**. The program schedule individual data generating unit **110** stores the generated program schedule individual data **160** in the program schedule individual data area **114***e* in the video memory **114**, as described later (see FIG. **9**).

FIG. **5** is a schematic diagram showing exemplary program schedule individual data **160**. As shown in the diagram, the program schedule individual data **160** include first header information **160***a*, second header information **160***b*, graphic rendering definitions **160***c*, and a raw material data reference table **160***d*.

The first header information **160***a* indicates the offset address from the top of the program schedule individual data **160** to the top of the raw material data reference table **160***d*.

The second header information **160***b* indicates the offset address from the top of the program schedule individual data **160** to the top of the vector data area **114***f*, which will be described later (see FIG. **9**), in the video memory **114**.

The graphic rendering definitions **160***c* represent rendering definitions for rendering an image for each program by use of the raw material data **150** constituting the program schedule individual data **160**. The graphic rendering definitions **160***c* include, for example, placement information, ID information, depth information, transformation matrix information, and end-of-frame information. The placement information defines the placement, update, or deletion of the raw material data **150**. The ID information defines the intended raw material data **150** by indexes. For example, 'ID=0' indicates the raw material data **150** stored at the first address in the raw material data reference table **160***d*. The depth information defines the order of overlap when images rendered with the raw material data **150** defined by the ID information are placed. The transformation matrix information defines parallel translation, enlargement, reduction, rotation, and color specifications for the placement or updating of images rendered with the raw material data **150** defined by the ID information. The end-of-frame information defines a change of frame.

The raw material data reference table **160***d* indicates the offset address from the top of the vector data area **114***f* (see FIG. **9**) in the video memory **114** to the top of the intended raw material data **150** for each index of the raw material data **150** used in the graphic rendering definitions **160***c*. The offset addresses are listed sequentially in the raw material data reference table **160***d*, starting from index '0' (ID=0).

In the example in FIG. **5**, the raw material data reference table **160***d* is located at address '0x00000140' from the top of

the program schedule individual data **160**, as indicated by the first header information **160***a*. The vector data area **114***f* in the video memory **114** is shown to be positioned at address '0x04000000' from the top of the program schedule individual data, as indicated by the second header information **160***b*. The program schedule individual data **160** are shown to be configured from multiple items of raw material data **150**; the raw material data **150** with ID=1 are shown to be stored at address '0x00344E20' from the top of the vector data area **114***f* in the video memory **114**, as indicated on the second line in the raw material data reference table **160***d*. The raw material data with ID=2 are shown to be stored address '0x00348086' from the top of the vector data area **114***f*, as indicated on the third line of the raw material data reference table **160***d*, and the image of the raw material data **150** with ID=2 is rendered at a position translated by 30 pixels in the X-direction from the image of the raw material data with ID=1.

Returning to the description of FIG. **1**, the program schedule display list generating unit **111** generates program schedule display lists **170** indicating the placement positions and display positions of the images rendered by use of the program schedule individual data **160** generated by the program schedule individual data generating unit **110**, and stores the program schedule display lists **170** in the video memory **114**.

FIG. **6** is a schematic diagram showing an example of the data structure of a program schedule display list **170**. As shown, the program schedule display list **170** gives a structural definition for each item of the program schedule individual data **160**, for use in configuring the program schedule screen by combining the images rendered on the basis of the program schedule individual data **160**. In the program schedule display list **170** there are four parameters: PL**1**, PL**2**, PL**3**, and PL**4**.

Parameter PL**1** indicates the address on the video memory **114** at which corresponding program schedule individual data **160** are stored.

Parameter PL**2** indicates the reference coordinates of the screen display region, which is the effective display region in which the corresponding program schedule individual data **160** are displayed on the program schedule screen.

Parameter PL**3** indicates the width and height of the screen display region when the corresponding program schedule individual data **160** are displayed on the program schedule screen.

Parameter PL**4** indicates the reference coordinates when the image of the corresponding program schedule individual data **160** is rendered. The program schedule display list **170** designates a PL**4** value here for each item of program schedule individual data **160**, so that the image for the program broadcast at the time and with the broadcast station ID indicated by the display reference position is displayed at the reference coordinates of the screen display region.

FIG. **7** is a schematic diagram showing an exemplary program schedule **180** based on the program schedule display list **170** in FIG. **6**. As shown in the diagram, the program schedule **180** is configured from a combination of single-program images rendered on the basis of program schedule individual data **160** for nine channels (horizontal) and nine hours (vertical).

FIG. **8** is a schematic diagram showing an exemplary screen display region **180***a* in the program schedule **180** based on the program schedule display list **170** shown in FIG. **6**. As illustrated, in the program schedule **180** structured horizontally for nine channels and vertically for nine hours on the basis of the program schedule individual data **160** and program schedule display list **170**, the rendering unit **115** renders images in a screen display region **180***a* extending for seven channels horizontally and six hours vertically. In other words, the screen display region **180***a* is the program schedule screen displayed on the display unit **116**.

In the example in FIG. **6**, from parameter PL**1**, the program schedule individual data #0002 defined on the first line are stored at address '0x02400000' on the video memory **114**; from parameters PL**2** and PL**3**, the screen display region **180***a* displayed as a program schedule screen has reference coordinates (X, Y)=(260, 260) and (width, height)=(1400, 960). From parameter PL**4**, the reference coordinates at which the image based on program schedule individual data #0002 is placed are (X, Y)=(60, 20). Accordingly, since the one-program image based on program schedule individual data #0002 is not included in the screen display region **180***a*, the rendering unit **115** does not perform any rendering on the basis of program schedule individual data #0002.

Similarly, from parameter PL**1**, the program schedule individual data #0102 defined on the fourth line are stored at address '0x02402200' on the video memory **114**; from parameters PL**2** and PL**3**, the screen display region **180***a* displayed as a program schedule screen has reference coordinates (X, Y)=(260, 260) and (width, height)=(1400, 960). From parameter PL**4**, the reference coordinates at which the image based on program schedule individual data #0002 is placed are (X, Y)=(260, 20) and it is not included in the screen display region **180***a*. The rendering unit **115** does not perform any rendering on the basis of program schedule individual data #0102.

In contrast, from parameter PL**1**, the program schedule individual data #0103 defined on the fifth line are stored at address '0x02402600' on the video memory **114**; from parameters PL**2** and PL**3**, the screen display region **180***a* displayed as a program schedule screen has reference coordinates (X, Y)=(260, 260) and (width, height)=(1400, 960). From parameter PL**4**, the reference coordinates at which the image based on program schedule individual data #0103 is placed are (X, Y)=(260, 180). Accordingly, the rendering unit **115** performs rendering on the basis of program schedule individual data #0103, but only the lower half (corresponding to the time from 10:30 to 11:00) is displayed on the program schedule screen.

Similarly, from parameter PL**1**, the program schedule individual data #0104 defined on the sixth line are stored at address '0x02402A00' on the video memory **114**; from parameters PL**2** and PL**3**, the screen display region **180***a* displayed as a program schedule screen has reference coordinates (X, Y)=(260, 260) and (width, height)=(1400, 960). From parameter PL**4**, the reference coordinates at which the image based on program schedule individual data #0104 is placed are (X, Y)=(260, 340). Accordingly, the rendering unit **115** performs rendering on the basis of program schedule individual data #0103, and the entire rendered image is displayed on the program schedule screen.

Returning to the description of FIG. **1**, the program schedule display list updating unit **112** updates the parameters of the program schedule display lists **170** stored on the video memory **114**, on the basis of the content of operations from the operation receiving unit **103**.

The clock **113** keeps time. This embodiment assumes that the time kept by the clock **113** is the current time.

The video memory **114** stores the vector data constituting the raw material data **150**, the program schedule individual data **160** generated in the program schedule individual data generating unit **110**, the program schedule display lists **170** generated by the program schedule display list generating unit **111**, and other data.

FIG. **9** is a schematic diagram showing an example of the structure of the video memory **114**. As shown, the video memory **114** includes a first frame buffer area **114***a*, a second frame buffer area **114***b*, a first program schedule display list area **114***c*, a second program schedule display list area **114***d*, a program schedule individual data area **114***e*, and a vector data area **114***f*.

The first frame buffer area **114***a* and second frame buffer area **114***b* store the frame data of the program schedule screen rendered by the rendering unit **115**. Here, the first frame buffer area **114***a* and second frame buffer area **114***b* store the frame data alternately. For example, when the first frame buffer area **114***a* stores the frame data of the currently displayed program schedule screen, the second frame buffer area **114***b* stores the frame data of the program schedule screen to be displayed next.

The first program schedule display list area **114***c* and second program schedule display list area **114***d* store program schedule display lists **170** generated by the program schedule display list generating unit **111**. Here, the first program schedule display list area **114***c* and second program schedule display list area **114***d* store the program schedule display lists **170** alternately. For example, when the first program schedule display list area **114***c* stores the program schedule display list **170** corresponding to the currently displayed program schedule screen, the second program schedule display list area **114***d* stores a program schedule display list **170** that was updated in the program schedule display list updating unit **112**.

The program schedule individual data area **114***e* stores the program schedule individual data **160** generated in the program schedule individual data generating unit **110**.

The vector data area **114***f* stores raw material data **150** stored in the data storing unit **106**.

Returning to the description of FIG. **1**, the rendering unit **115** is a graphics engine for processing vector data, and operates by receives instructions from the control unit **108**. For example, when the rendering unit **115** receives a display instruction or a switch-over instruction from the program schedule control unit **109** in the control unit **108**, it decodes the vector data defined by the program schedule individual data **160** stored in the video memory **114** on the basis of a program schedule display list **170**, stored in the video memory **114**, that is designated by the program schedule control unit **109**, thereby rendering images, and combines the images, thereby generating the image data of the program schedule screen. Then the rendering unit **115** sends the generated image data to the display unit **116**.

Based on the image data acquired from the rendering unit **115**, the display unit **116** displays the screen.

The control unit **108**, vector data management information storing unit **104**, program information storing unit **105**, base data storing unit **107**, and rendering unit **115** may be configured from an integrated circuit including, for example, a CPU or other microprocessor, ROM (Read Only Memory), RAM (Random Access Memory), a timer circuit, an input/output interface, and special processing units. Some or all of the functions of the control unit **108**, vector data management information storing unit **104**, program information storing unit **105**, base data storing unit **107**, and rendering unit **115** may be implemented either by hardware or by having a microprocessor execute prescribed computer programs. Furthermore, when some or all of the functions of the control unit **108**, vector data management information storing unit **104**, base data storing unit **107**, and rendering unit **115** are implemented by computer programs (including executable files), the microprocessor can load computer programs or corresponding executable files from a computer-readable recording medium and execute them to implement the functions. The data storing unit **106** can be implemented by use of a storage device, such as a nonvolatile memory, an HDD (hard disc drive), or a read-write device equipped with an optical disc.

The operation of the program schedule generating device **100** with the above configuration will now be described.

FIG. **10** is a flowchart schematically illustrating the initial processing by the program schedule generating device **100**. The control unit **108** of the program schedule generating device **100** initiates the flow in FIG. **10** at startup, for example, or at other times.

First the program schedule control unit **109** loads the raw material data **150** stored in the data storing unit **106** (S**10**).

Then the program schedule control unit **109** determines the raw material types of the loaded raw material data **150** (S**11**). When the result of the determination is font data, the program schedule control unit **109** proceeds to the processing in step S**12**; when the result of the determination is not font data, it proceeds to the processing in step S**14**. Here, the program schedule control unit **109** may perform this determination according to a file extension. The raw material data **150** may be stored in different folders in the data storing unit **106**, classified according to raw material type.

In step S**12**, the program schedule control unit **109** generates font IDs from the data identification information assigned to the font data, refers to the raw material data **150** that are font data, thereby obtains the address, in the font data, and size of the glyph data corresponding to each character code, and stores this information in the corresponding fields to generate the font table **130** (see FIG. **3**).

Next, the program schedule control unit **109** stores the font table **130** generated in step S**12** in the vector data management information storing unit **104** (S**13**).

In step S**14**, the program schedule control unit **109** writes the raw material data **150** loaded in step S**10** into the vector data area **114***f* (see FIG. **9**) in the video memory **114**.

Next, the program schedule control unit **109** stores information for the raw material data **150** written into the video memory **114** in the raw material data expansion table **120** stored in the vector data management information storing unit **104**, thereby updating the raw material data expansion table **120** (S**15**). Among the raw material data **150** that were loaded in step S**10**, for the data that were determined to be font data in step S**11**, for example, the program schedule control unit **109** generates a registration name (index) by assigning '01' as the raw material type and adding 'Font_' at the head of the data identifier assigned to the raw material data **150** as its registration name. Among the raw material data **150** that were loaded in step S**10**, for the data that were not determined to be font data in step S**11**, it assigns '02' as the raw material type, and as the registration name, it generates a registration name (index) by adding 'Path_' at the head of the data identifier preassigned to the raw material data **150**. Then the program schedule control unit **109** stores the above information and the addresses at which individual raw material data **150** are stored in the video memory **114** in the corresponding fields in the raw material data expansion table **120**.

FIG. **11** is a flowchart schematically illustrating the processing when the program information is updated in the program schedule generating device **100**. The control unit **108** initiates the flow in FIG. **11** when it receives program information from the program information receiving unit **102**.

First, the program schedule control unit **109** compares the content of the program information reported by the program information receiving unit **102** and the content of the program

data generating information in the program schedule related information **140** stored in the program information storing unit **105**, and extracts updated information for programs that have ended or been added or altered (S**20**).

Next, the program schedule control unit **109** updates the program data generating information in the program schedule related information **140** to reflect the content of the updated information (S**21**). For an added or altered program, the data address, which is an element of the program data generating information, is here initialized to '0xFFFFFFFF'.

FIG. **12** is a flowchart schematically illustrating the processing carried out in the program schedule generating device **100** when a user operation is performed. The control unit **108** initiates the flowchart in FIG. **12** when it receives the content of the operation from the operation receiving unit **103**.

First, the program schedule control unit **109** in the control unit **108** determines the content of the user operation reported by the operation receiving unit **103** (S**30**). Then, if the operation content is determined to indicate that display of the program schedule is to start, the program schedule control unit **109** proceeds to the processing in step S**31**; if the operation content is determined to indicate an update of the displayed content of the program schedule, such as a scroll operation, the program schedule control unit **109** proceeds to the processing in step S**37**; if the operation content is determined to indicate that display of the program schedule is to end, it proceeds to the processing in step S**44**.

In step S**31**, the program schedule control unit **109** reads the display reference position at which to display the program schedule from the program schedule related information **140** stored in the program information storing unit **105**. Then, if the time included in the display reference position that is read is previous to the current time kept by the clock **113**, the program schedule control unit **109** updates the time included in the display reference position to the current time. For example, if the broadcast station ID at the display reference position that was read is 'CH01', the time is 'August 7 10:30', and the current time given by the clock is 'August 8 10:23', the program schedule control unit **109** updates the time included in the display reference position to 'August 8 10:30', so that the program currently being broadcast is displayed at the display reference position. In this way, the program schedule control unit **109** determines the display reference position based on which the program schedule will be displayed.

The program schedule individual data generating unit **110** then identifies relevant programs from the program schedule related information **140** stored in the program information storing unit **105**, on the basis of the display reference position identified in step S**31**, and generates the program schedule individual data **160** on the basis of the program data generating information of the identified programs (S**32**). If the broadcast station ID and time at the identified display reference position are 'CH01' and 'August 8 10:30', the number of broadcast stations displayed on one screen is '7' and the time displayed on one screen is '6 hours', for example, then the relevant programs for which program schedule individual data **160** are generated are the programs broadcast by broadcast stations 'CH00' to 'CH08' from 'August 8 9:30' to 'August 8 17:30'. In other words, program schedule individual data **160** are generated for the programs broadcast on the channels in a given span of channels preceding and following the channel indicated by the broadcast station ID at the display reference position and in a given span of time preceding and following the time at the display reference position.

The program schedule individual data generating unit **110** determines the display regions of the programs from the program schedule individual data **160** for the relevant programs, the width per broadcast station and height per hour as the display parameters stored in the base data storing unit **107**, and the start and end times in the program data generating information included in the program schedule related information **140**. Then the program schedule individual data generating unit **110** identifies the background colors in the display regions according to the genres indicated by the program data generating information, by referring to the generating rule information stored in the base data storing unit **107**. The program schedule individual data generating unit **110** also refers to the generating rule information stored in the base data storing unit **107** to identify the fonts used to display the titles and summaries of the programs. Then The program schedule individual data generating unit **110** creates a graphic rendering definition **160***c* for each character or graphics data item according to the identified display regions, background colors, and fonts for the background, titles, and summaries of the programs. The program schedule individual data generating unit **110** also generates a raw material data reference table **160***d* by identifying the addresses of the applicable raw material data **150** in the vector data area **114***f* of the video memory **114** from the raw material data expansion table **120** and font table **130** in the vector data management information storing unit **104**.

Specifically, the program schedule individual data generating unit **110** places rectangular data with graphic rendering definition ID=0 and depth=0, and uses a matrix transformation to specify horizontal and vertical enlargement and reduction in order to obtain a size fitting the display region of the program, and a color to provide a background color appropriate for the program genre. Then the program schedule individual data generating unit **110** stores, in the raw material data reference table **160***d*, an offset address, from the top of the vector data area **114***f* on the video memory **114**, at which the rectangular data are stored.

Next, if the title begins with the hiragana character 'o' with font ID=003, the program schedule individual data generating unit **110** places the character 'o' in the font with ID=003 in a graphic rendering definition, setting ID=1 and depth=1.

Then the program schedule individual data generating unit **110** calculates the an offset address, from the top of the vector data area **114***f* on the video memory **114**, at which the character 'o' in the font with ID=003 is stored and stores the calculated offset address in the raw material data reference table **160***d*. For example, from the raw material data expansion table **120** stored in the vector data management information storing unit **104**, it can be seen that the font data with font ID=003 (Font_003) are expanded at '0x06250000' on the video memory **114**. From the font table **130** stored in the vector data management information storing unit **104**, it can be seen that the character 'o' with the font ID=003 is located at address '0x000F4E20' in the font data. Accordingly, the program schedule individual data generating unit **110** adds the address '0x000F4E20' of 'o' in the font data to the address '0x06250000' of the font data on the video memory **114**, thereby calculating the address '0x06344E20' of 'o' on the video memory **114**. Consequently, the offset address from the top address '0x06000000' of the vector data area **114***f* is '0x00344E20'.

Similarly, if the next data of the title is the hiragana character 'ha' with the font ID=003, the program schedule individual data generating unit **110** places the character 'ha' in the font with ID=003 in a graphic rendering definition with a displacement of 30 pixels in the X direction, setting ID=2 and depth=2.

Then, the program schedule individual data generating unit **110** calculates an offset address, from the top of the vector

data area **114***f* on the video memory **114**, at which the character 'ha' with the font ID=003 is stored and stores the calculated offset address in the raw material data reference table **160***d*. For example, from the raw material data expansion table **120** stored in the vector data management information storing unit **104**, it can be seen that the font data with font ID=003 (Font_003) are expanded at '0x06250000' on the video memory **114**. From the font table **130** stored in the vector data management information storing unit **104**, it can be seen that the character 'ha' with the font ID=003 is located at address '0x000F8086' in the font data. Accordingly, the program schedule individual data generating unit **110** adds '0x000F8086' to '0x06250000', thereby calculating the address '0x06348086' of 'ha' on the video memory **114**. Consequently, the offset address from the top address '0x06000000' of the vector data area **114***f* is '0x00348086'.

If the address in the program schedule individual data area **114***e* of the video memory **114** storing the program schedule individual data **160** is '0x02000000', the second header information **160***b* in the program schedule individual data **160** is the difference from the top address '0x06000000' of the vector data area **114***f*, which is '0x04000000'.

Then the program schedule individual data generating unit **110** performs similar processing on the raw material data **150** which can be placed in the display region of the program, and after the size of the graphic rendering definitions **160***c* is determined, it generates an offset address from the head of the program schedule individual data **160** to the head of the raw material data reference table **160***d* and stores the generated offset address in the first header information **160***a*.

Next, the program schedule individual data generating unit **110** stores the generated program schedule individual data **160** in the program schedule individual data area **114***e* on the video memory **114** and writes the address information at the data address of the corresponding program ID in the program data generating information included in the program schedule related information **140** stored in the program information storing unit **105** (S**33**).

Next, the program schedule display list generating unit **111** uses the program schedule individual data **160** generated in step S**32** to generate the program schedule display list **170** (S**34**). In this step, the program schedule display list generating unit **111** refers to the generating rule information stored in the base data storing unit **107** to determine the placement of the channels and the position of the screen display region. By generating program schedule individual data **160** for the programs surrounding the screen display region **180***a*, such as the programs for one broadcast station on both the right and left sides in the X direction and for one hour both above and below in the Y direction, and adding them to the program schedule display list **170** in step S**32**, it becomes possible, when the user operation content is an update operation, to update the content of the program schedule displayed on the display unit **116** just by updating the content of the program schedule display list **170**.

Next, the program schedule display list generating unit **111** stores the generated program schedule display list **170** in the first program schedule display list area **114***c* or the second program schedule display list area **114***d* on the video memory **114**, whichever has free space (S**35**).

The program schedule control unit **109** then issues a display start instruction to the rendering unit **115** on the basis of the program schedule display list **170** stored in step S**35** (S**36**). On the basis of the display start instruction from the control unit **108**, the rendering unit **115** decodes the raw material data **150** defined by the program schedule individual data on the basis of the specified program schedule display list **170** and combines the images, thereby generating the screen data of the program schedule screen.

If the operation content indicates an update operation (S**30**), however, the program schedule control unit **109** proceeds to the processing in step S**37**.

In step S**37**, the program schedule control unit **109** reads the display reference position for displaying the program schedule from the program schedule related information **140** stored in the program information storing unit **105**, and updates the content of the display reference position according to the content of the user operation. If the user operation content is a displacement operation in the X direction, for example, it updates the broadcast station ID at the display reference position so as to indicate the broadcast station ID at the destination position of the displacement indicated by the operation; if the user operation is a displacement operation in the Y direction, it updates the time at the display reference position so as to indicate the time at the destination position of the displacement indicated by the operation.

Next, the program schedule individual data generating unit **110** updates the PL**4** parameter values in the program schedule individual data **160** specified in the program schedule display list **170** on the basis of the updated display reference positions in the program information storing unit **105** (S**38**). In this example, the program schedule individual data generating unit **110** updates the PL**4** values of all the program schedule individual data **160** so that the PL**4** values of the program schedule individual data **160** of the program to be broadcast by the broadcast station indicated at the display reference position and at the time indicated at the display reference position are equal to the PL**2** value. Here, since the rendering unit **115** decodes the raw material data **160** defined by the program schedule individual data **160** on the basis of the updated program schedule display list **170**, the displayed content of the program schedule displayed on the display unit **116** is scrolled responsive to the displacement indicated by the user operation.

Then the program schedule individual data generating unit **110** generates program schedule individual data **160** for programs that have become newly relevant according to the updated display reference position in the program schedule related information **140** stored in the program information storing unit **105**, on the basis of their program data generating information (S**39**).

Next, the program schedule individual data generating unit **110** stores the program schedule individual data **160** generated in step S**39** in the program schedule individual data area **114***e* on the video memory **114** (S**40**). The program schedule individual data generating unit **110** writes address information for the program schedule individual data **160** stored in step S**40** as the data addresses of the corresponding program IDs of the program data generating information. Conversely, regarding programs for which there is no longer need to generate program schedule individual data **160**, the data addresses of the corresponding program IDs are initialized to '0xFFFFFFFF'. Here, in the program schedule individual data area **114***e* on the video memory **114**, the program schedule individual data **160** of newly added programs may be stored in the area used for programs for which program schedule individual data **160** need no longer be generated, using a fixed data size for each program. The program schedule individual data generating unit **110** may also store the program schedule individual data **160** by using the program schedule individual data area **114***e* on the video memory **114** as a ring buffer.

Next, the program schedule display list generating unit **111** uses the display reference position updated in the program

schedule related information **140** stored in the program information storing unit **105** and the program schedule individual data **160** generated in step S**40** to generate a program schedule display list **170** (S**41**). The program schedule display list generating unit **111** then stores the generated program schedule display list **170** in whichever of the first program schedule display list area **114***c* and second program schedule display list area **114***d* on the video memory **114** is not currently being used (S**42**).

Then the program schedule control unit **109** gives the rendering unit **115** a switch-over instruction to decode the program schedule individual data **160** on the basis of the program schedule display list **170** stored in step S**42** (S**43**). On the basis of the switch-over instruction from the control unit **108**, the rendering unit **115** performs decoding based on the specified program schedule display list **170** and program schedule individual data **160**, thereby rendering images and generating screen data for the program schedule screen.

Here, referring to FIG. **8**, if the broadcast station and time spans for which program schedule individual data **160** are generated are sufficiently large in relation to the screen display region **180***a*, it is also possible to set respective broadcast station and time threshold values and omit the processing in step S**41**, step S**42**, and step S**43** unless the displacement indicated by the user operation exceeds the threshold value.

If the operation content indicates a termination operation (S**30**), the program schedule control unit **109** proceeds to the processing in step S**44**.

In step S**44**, the program schedule control unit **109** notifies the rendering unit **115** of the end of the display, thereby causing it to terminate the display of the program schedule screen.

In the flowchart in FIG. **12** described above, in step S**32**, program schedule individual data are also generated for programs with channels and times surrounding the screen display region **180***a*, but this is not a limitation. The program schedule individual data generating unit **110** may, for example, generate program schedule individual data only for the programs included in the screen display region **180***a*.

In step S**38** in the flowchart in FIG. **12** described above, when the program schedule screen is scrolled by a user operation, for channels and times corresponding to programs for which no program schedule individual data **160** has been generated yet, a predetermined background or the like may be displayed without displaying images of the programs on the program display screen.

The flowchart in FIG. **12** illustrates processing when there is user operation input, but when a given time elapses during the display of the program schedule and a broadcast program has ended, for example, the program schedule control unit **109** may update the time indicated at the display reference position to the current time and the processing in step S**37** and the following steps may then be carried out.

As described above, the program schedule generating device **100** expands, in advance, the vector data needed as raw material data for dynamic generation of the program schedule display lists **170** defining combinations of multiple items of the program schedule individual data **160** used by the rendering unit **115** to generate the screen data, extracts information needed to generate the program schedule individual data **160** and program schedule display lists **170**, and stores the information in the vector data management information storing unit **104**, thereby enabling the data size of the program schedule individual data **160** and program schedule display lists **170** and the amount of processing required to generate them to be reduced.

In generating the program schedule individual data **160** for sixteen programs with 50 characters per program and an assumed average vector data size per character of 600 bytes, copies from the data storing unit **106** occur 800 times (=50 characters×16 programs). The total data size is about 470 kilobytes (=600 bytes×50 characters×16 programs). In the present embodiment, however, the first header information **160***a* and second header information **160***b* have a size of 8 bytes, at 8 bytes per character the graphic rendering definitions **160***c* total 400 bytes, and at 4 bytes per character the raw material data reference table **160***d* totals 200 bytes, making 608 bytes per program and less than 10 kilobytes for 16 programs.

In the embodiment described above, during a scroll operation the program schedule display list updating unit **112** updates the PL**4** values in the program schedule display list **170**, but instead, it may, for example, update the PL**2** values in the program schedule display list **170**, that is, the reference coordinates at which the screen display region **180***a* is placed.

The embodiment described above shows an example in which the invention is applied to a program schedule generating device **100**, but the invention may also be applied to other devices, such as, for example, video receiving devices, video receiving and display devices, or video storing and reproducing devices.

Reference Characters

**100** program schedule generating device, **101** reception processing unit, **102** program information receiving unit, **103** operation receiving unit, **104** vector data management information storing unit, **105** program information storing unit, **106** data storing unit, **107** base data storing unit, **108** control unit, **109** program schedule control unit, **110** program schedule individual data generating unit, **111** program schedule display list generating unit, **112** program schedule display list updating unit, **113** clock, **114** video memory, **115** rendering unit, **116** display unit.

What is claimed is:

**1**. A program schedule generating device, comprising:

a video memory for storing raw material data that are vector data for image rendering;

a program information storing unit for storing program data generating information for each program, including display information to be displayed in a program schedule;

a program schedule individual data generating unit for generating program schedule individual data for each program, including graphic rendering definitions for using the raw material data to form an image indicating the display information, and raw material data reference information indicating storage locations, in the video memory, of the raw material data used in the graphic rendering definitions;

a program schedule display list generating unit for generating a program schedule display list indicating, for each of the program schedule individual data, a position at which to place the image rendered on a basis of the program schedule individual data; and

a rendering unit for rendering the image for each program by use of the raw material data on the basis of the program schedule individual data and placing the rendered image on a basis of the program schedule display list, thereby generating screen data for a program schedule screen.

**2**. The program schedule generating device of claim **1**, wherein:

the program data generating information further includes information indicating a broadcast station and time of broadcast for each program;

the program information storing unit also stores display reference information indicating a broadcast station and a time used as a reference for display of the program schedule;

the program schedule individual data generating unit identifies channels and times in the program schedule on a basis of the display reference information and generates the program schedule individual data for each program broadcast on the identified channels at the identified times; and

the program schedule display list generating unit generates the program schedule display list such that the image of the program broadcast by the broadcast station indicated by the display reference information at the time indicated by the display reference information is placed at a predetermined position.

**3**. The program schedule generating device of claim **2**, further comprising:

a program information acquiring unit for receiving a digital broadcast signal and acquiring program information including information related to programs to be broadcast; and

a program schedule control unit for updating the program data generating information on the basis of the program information acquired by the program information acquiring unit; wherein

the program schedule individual data generating unit generates the program schedule individual data on a basis of the updated program data generating information.

**4**. The program schedule generating device of claim **3**, further comprising a clock for keeping current time, wherein:

the program schedule control unit updates the time indicated by the display reference information such that the time indicated by the display reference information indicates the current time kept by the clock;

the program schedule individual data generating unit generates the program schedule individual data on a basis of the updated display reference information; and

the program schedule display list generating unit generates the program schedule display list on the basis of the updated display reference information.

**5**. The program schedule generating device of claim **3**, further comprising:

an operation receiving unit for receiving input of a scroll operation for the program schedule screen; and

a program schedule display list updating unit for updating the program schedule display list; wherein

the program schedule control unit updates at least one of the broadcast station and the time indicated by the display reference information, according to a displacement performed by the scroll operation; and

the program schedule display list updating unit updates the program schedule display list such that the image of the program broadcast by the broadcast station indicated by the updated display reference information at time indicated by the updated display reference information is placed at the predetermined position.

**6**. The program schedule generating device of claim **5**, wherein:

the program schedule individual data generating unit also generates the program schedule individual data for programs included in channels and times in a given range preceding and following the channels and times of the programs included in the program schedule screen;

the program schedule display list also indicates positions at which to place images rendered on a basis of the program individual data of the programs included in the channels and times within the given range preceding and following the channels and times of the programs in the program schedule screen; and

the rendering unit does not render images on the basis of the program schedule individual data for programs that, on the basis of the program schedule display list, are not included in the program schedule screen.

**7**. The program schedule generating device of claim **5**, wherein the program schedule individual data generating unit identifies the channels and the times in the program schedule on the basis of the updated display reference information and identifies the programs broadcast on the identified channels at the identified times, and if there is a program among the identified programs for which program schedule individual data have not been generated, generates the program schedule individual data for the program for which the program schedule individual data have not been generated.

**8**. The program schedule generating device of claim **7**, wherein:

the program schedule display list generating unit newly generates a program schedule display list on the basis of the updated display reference information; and

the rendering unit generates the screen data for the program schedule screen by placing the rendered images on a basis of the newly generated program schedule display list.

**9**. The program schedule generating device of claim **6**, wherein:

the program schedule display list generating unit newly generates the program schedule display list on the basis of the updated display reference information when the displacement performed by the scroll operation exceeds a predetermined threshold value; and

the rendering unit generates the screen data for the program schedule screen by placing the rendered images on a basis of the newly generated program schedule display list.

**10**. A program schedule generating method, comprising:

a program information storing process for storing program data generating information for each program, including display information to be displayed for each program in a program schedule;

a program schedule individual data generating process for generating program schedule individual data for each program, including graphic rendering definitions for using the raw material data to form an image indicating the display information, and raw material data reference information indicating storage locations, in the video memory, of the raw material data used in the graphic rendering definitions;

a program schedule display list generating process for generating a program schedule display list indicating, for each of the program schedule individual data, a position at which to place the image rendered on a basis of the program schedule individual data; and

a rendering process for rendering the image for each program by use of the raw material data on the basis of the program schedule individual data and placing the rendered image on a basis of the program schedule display list, thereby generating screen data for a program schedule screen.

**11**. The program schedule generating method of claim **10**, wherein:

the program data generating information further includes information indicating a broadcast station and a time of broadcast for each program;

the program schedule individual data generating process identifies channels and times in the program schedule on a basis of the display reference information and generates the program schedule individual data for each program broadcast on the identified channels at the identified times; and

the program schedule display list generating process generates the program schedule display list such that the image of the program broadcast by the broadcast station indicated by the display reference information at the time indicated by the display reference information is placed at a predetermined position.

**12**. The program schedule generating method of claim **11**, further comprising:

a program information acquiring process for receiving a digital broadcast signal and acquiring program information including information related to programs to be broadcast; and

a program schedule control process for updating the program data generating information on the basis of the program information acquired by the program information acquiring process; wherein

the program schedule individual data generating process generates the program schedule individual data on a basis of the updated program data generating information.

**13**. The program schedule generating method of claim **12**, further comprising:

a clock process for keeping current time; and

a second program data updating process for updating the time indicated by the display reference information such that the time indicated by the display reference information indicates the current time kept by the clock process; wherein

the program schedule individual data generating process generates the program schedule individual data on a basis of the updated display reference information; and

the program schedule display list generating process generates the program schedule display list on the basis of the updated display reference information.

**14**. The program schedule generating method of claim **12**, further comprising:

an operation receiving process for receiving input of a scroll operation for the program schedule screen;

a third program data updating process for updating at least one of the broadcast station and the time indicated by the display reference information, according to a displacement performed by the scroll operation; and

a program schedule display list updating process for updating the program schedule display list such that the image of the program broadcast by the broadcast station indicated by the updated display reference information at the time indicated by the updated display reference information is placed at the predetermined position.

**15**. The program schedule generating method of claim **14**, wherein:

the program schedule individual data generating process also generates the program schedule individual data for programs included in channels and times within a given range preceding and following the channels and times of the programs included in the program schedule screen;

the program schedule display list also indicates positions at which to place images rendered on a basis of the program individual data of the programs included in the channels and times within the given range preceding and following the channels and times of the programs in the program schedule screen; and

the rendering process does not render images on the basis of the program schedule individual data for programs that, on the basis of the program schedule display list, are not included in the program schedule screen.

**16**. The program schedule generating method of claim **14**, further comprising a program schedule individual data regenerating process for identifying channels and the times in the program schedule on the basis of the updated display reference information, identifying programs broadcast on the identified channels at the identified times, and if there is a program among the identified programs for which program schedule individual data have not been generated, generating the program schedule individual data for the program for which the program schedule individual data have not been generated.

**17**. The program schedule generating method of claim **16**, further comprising:

a program schedule display list generating process for newly generating the program schedule display list on the basis of the updated display reference information; and

a re-rendering process for generating the screen data for the program schedule screen by placing the rendered images on the basis of the newly generated program schedule display list.

**18**. The program schedule generating method of claim **15**, further comprising:

a program schedule display list regenerating process for newly generating the program schedule display list on the basis of the updated display reference information when the displacement performed by the scroll operation exceeds a predetermined threshold value; and

a re-rendering process for generating the screen data for the program schedule screen by placing the rendered images on a basis of the newly generated program schedule display list.

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